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Which Aspects of Education Matter for Early Adult Mortality? Evidence from the High School and Beyond Cohort

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Abstract

What dimensions of education matter for people's chances of surviving young adulthood? Do cognitive skills, non-cognitive skills, course taking patterns, and school social contexts matter for young adult mortality, even net of educational attainment? We analyze data from High School & Beyond—a nationally representative cohort of ~25,000 high school students first interviewed in 1980. Many dimensions of education are associated with young adult mortality, and high school students' math course taking retain their associations with mortality net of educational attainment. Our work draws on theories and measures from sociological and educational research and enriches public health, economic, and demographic research on educational gradients in mortality that has almost exclusively relied on ideas of human capital accumulation and measures of degree attainment. Our findings also call on social and education researchers to engage together in research on the life-long consequences of educational processes, school structures, and inequalities in opportunities to learn.

Keywords

Education; Mortality; Cognitive Skills; Non-Cognitive Skills; Opportunity to Learn

Sociologists of education often debate whether schools and education systems mainly *reproduce* existing social, racial and economic inequalities or mainly help to *overcome* those inequalities (e.g., Darling-Hammond 2010, Downey and Condron 2016, Jennings et al. 2015, Raudenbush and Eschmann 2015). In almost all cases, scholarship in this tradition

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focuses on educational outcomes (e.g., test scores, degree attainment) or labor market outcomes (e.g., employment, income). Sociologists of education, and education researchers more broadly, rarely consider the implications of educational and schooling processes for inequalities in health and longevity. In fact, the word "mortality" has never appeared in the title of any article ever published in the American Sociological Association's *Sociology of Education* or in any of the American Educational Research Association's journals. If a key aim of education research (in sociology and elsewhere) is to comprehensively understand whether schools and educational processes alleviate or exacerbate inequalities by socioeconomic background and race, then they must broaden the scope of scholarship to encompass the consequences of schooling and educational processes for mortality.

At the same time, health sociologists, demographers, and public health researchers have long shown that educational attainment is a major determinant of mortality and longevity (Hummer and Hernandez 2013). In fields like public health, demography, public policy, economics, and medical sociology, many researchers are centrally concerned with the implications of educational attainment for disparities in mortality. Just since 2000, dozens of articles have appeared in journals in those fields with both "education" and "mortality" in their titles. Despite their success in *describing* educational attainment gradients, however, researchers in medical sociology, demography, and public health rarely engage sociology of education researchers' theories, concepts, measures, or data that could answer key questions of *how* and *why* education shapes racial/ethnic and socioeconomic differences in morbidity and mortality. They typically ignore important debates that pre-occupy many researchers who work in the area of sociology of education: What aspects of educational experiences and schooling processes matter most? Through what theoretical pathways do those effects operate? Statistical analyses of educational attainment gradients in mortality in medical sociology, demography, and public health virtually always limits itself to measures of years of schooling completed or highest degree obtained. Virtually no published research in these and related fields seriously considers how other aspects of education contribute to gradients in mortality. As we argue below, this narrow conceptualization of what education represents is based partly on data constraints and partly on a narrow theoretical and conceptual perspective on the pathways through which education shapes mortality patterns.

As sociologists of education understand, educational attainment and degree completion shape and are shaped by other factors related to process—such as the development of cognitive skills, non-cognitive skills, exposure to knowledge, opportunities to learn, and school social contexts—that may themselves influence the risk of mortality. Mortality scholars in public health and elsewhere generally do not consider these other factors (which in any case are rarely included in the data on which research on mortality gradients is usually based). Although (as we review below) a few scholars outside of education research recognize the potential importance of cognitive skills, non-cognitive skills, exposure to knowledge, and school social contexts for mortality, the lack of available data means that those scholars have generally had no choice but to exclusively rely on measures on degree attainment or years of schooling completed in their research.

Relying on rich data on the experiences of one cohort of Americans who were initially interviewed in high school and are now in their early-50s, we ask whether the cognitive and non-cognitive skills that adolescents develop, the knowledge and information to which they have been exposed, and the social contexts in the schools they attend matter for young adult mortality above and beyond traditional indicators of educational attainment. If they do, this raises important concerns about the validity and interpretation of previous findings about the effects of educational attainment on mortality. Our analyses also speak to how skills, schooling processes, social contexts, and educational attainments are interrelated and to the processes and pathways through which education (however conceptualized) shape mortality through midlife.

In a larger sense, we aim to merge the literatures from the sociology of education, medical sociology, demography, and public health to better understand how and why various dimensions of education might matter most for mortality through midlife in American society. More specifically, we develop competing conceptual frameworks linking various dimensions of education to early adult mortality in the United States and test which of the frameworks is best supported by new and innovative longitudinal data from High School and Beyond.

Educational Attainment and Young Adult Mortality

There is a very well-developed literature on educational attainment and U.S. early adult mortality. Kitagawa and Hauser's (1973) landmark study is the foundation of that literature. They first demonstrated, with high-quality data from 1960 at the national level, sizable mortality gradients by educational attainment for both white women and men aged 25–64. Moreover, there was a true gradient across the range of educational attainment, with each higher category of attainment characterized by a lower age-standardized mortality rate. Nonwhite women and men showed similar gradients as whites, although data limitations at the time prevented the separate examination of specific minority populations.

A great deal of subsequent work has documented changes in the education-mortality gradients over time. A first set of studies used data from the 1980s and, comparing the findings to those of Kitagawa and Hauser (1973), found clearly widening gradients for working-aged men compared to 1960 (Feldman et al. 1989, Pappas et al. 1993, Preston and Elo 1995). At the same time, the gradient for women contracted between 1960 and 1985 (Preston and Elo 1995). A more recent group of studies used data from the 2000s to compare back to the 1980s. In this set of studies, there was clear consensus—based on a number of different data sources—that education-mortality gradients for working-aged women and men widened between the 1980s and 2010s (Jemal et al. 2008, Meara, Richards and Cutiew 2008, Miech et al. 2011, Montez et al. 2011, Olshansky et al. 2012, Sasson 2016). Such widening has operated on a cohort-bycohort basis (Masters, Hummer and Powers 2012); thus, the largest relative educational gradients in U.S. adult mortality are now experienced by relatively young adults—the group that we analyze below. For example, both women and men in the lowest educated contemporary category of less than 12 years now exhibit about three times the risk of death at ages 25–44 as their highest educated (17 or more years) sex-specific counterparts (Hummer and Lariscy 2011).

The time trend work on educational attainment and mortality has been grounded in the idea that the causal importance of educational attainment for health and survival has likely increased, given the rapid social and technological changes unfolding in the late 20th and early 21st centuries (Hayward, Hummer and Sasson 2015, Masters, Hummer and Powers 2012). Thus, for example, a high level of educational attainment in the contemporary U.S. not only helps individuals obtain better jobs and earn more money, but also provides a set of flexible resources—such as enhanced knowledge, improved cognitive and non-cognitive skills, and beneficial social connections—that individuals use to prevent accidents, avoid dangerous situations, maintain good health, and better treat and manage illnesses when they strike (Baker et al. 2011, Elo and Preston 1996, Link and Phelan 1995). As a result, highly educated young adults in recent decades have experienced declining mortality rates from a range of preventable causes of death – accidents, poisonings, heart disease, lung cancer – while mortality rates from these same causes among less educated young adults have largely stagnated or, in some cases (e.g., drug overdoses), even increased (Case and Deaton 2015, Masters, Hummer and Powers 2012, Miech et al. 2011).

All the above studies (and more) have given the scientific and policy communities tremendous insights into the patterns and trends characterizing educational differences in U.S. young adult mortality. At the same time, all the above studies necessarily rely on very large multi-purpose data sets to describe such patterns and trends. While such data sets are extraordinarily valuable, their near exclusive use in this literature poses two problems. First, such data sets seldom include measures of potentially important confounders of the association between educational attainment and mortality (e.g., parents' education; child health; early-life measures of cognitive and non-cognitive skills) that may influence both educational attainment and young adult mortality (Hummer and Hernandez 2013). One exception is that of Hayward and Gorman (2004), who found that the association between educational attainment and U.S. older adult male mortality was unaffected by controls for individuals' own child health status and parents' socioeconomic background.

A second limitation is that the very large data sets used to document education-mortality patterns and trends are almost always limited to a single measure of educational attainment —either years of schooling completed or highest degree attained—and do not include measures of related concepts—e.g., exposure to knowledge, the development of cognitive and non-cognitive skills, access to social networks—that are also associated with young adult mortality risk. As we argue below, the omission of these sorts of measures may be problematic—and indeed, may bias inferences about the effects of educational attainment on early adult mortality risk—under certain conditions.

Conceptual Framework

What does "education" mean for the purposes of research on educational gradients in early adult mortality? Without a good, conceptually grounded answer to that question it is difficult to know how to measure that concept, how to fully interpret the results of empirical analyses, and how to assess the validity and completeness of previous research. In this section we first review several notions about what education represents in research on mortality gradients; each has appeared in various places in the research literature. After reviewing these several different conceptualizations, we make the case for thinking carefully about the causal processes linking early adult mortality risk, educational attainment, cognitive skills, non-cognitive skills, and exposure to knowledge and social networks.

Education as Market Commodity

Many scholars view education as representing a commodity—call it human capital—that can be exchanged for economic and other resources (e.g., higher income, safer jobs, health insurance, better doctors, healthier food, safer neighborhoods, cleaner water) that promote health and longevity (Cutler and Lleras-Muney 2006). Additional years of schooling and additional educational credentials—while not the same thing (Liu et al. 2011, Liu et al. 2013)—are both rewarded in the labor market with better pay, and money can buy better health. For people in the High School and Beyond cohort—who are in their 50s when observed in our data and thus for whom accidents, suicide, and homicide are the most common causes of death—human capital can be translated into safer cars (car accidents being the leading cause of accidental death), access to better mental health care, and wealthier neighborhoods (in which homicide rates are lower).

From this point of view, attributes like cognitive skills, non-cognitive skills, and schooling processes matter for early mortality only by influencing educational attainment; it is the possession of the commodity itself that matters for health and longevity (via various subsequent causal pathways like access to safer cars, mental health care, and wealthier neighborhoods that all reduce the risks of the most common causes of death in this cohort). Accordingly, research on education and mortality only needs to measure "years of schooling" or "highest degree completed"; cognitive and non-cognitive skills and school social contexts only matter to the extent that they shape human capital as indexed by attainment.

Education as Cognitive Skill

Cognitive skills—generally, the ability to acquire, store, and process information—are associated with health and longevity (Batty, Deary and Gottfredson 2007, Gottfredson 2004, Gottfredson and Deary 2004, Hauser and Palloni 2011, Willis et al. 2006, Wrulich et al. 2014). Cognitive skills are sometimes defined broadly in terms of IQ or general cognitive capacity. In contrast, research on the effects of health literacy on mortality often defines health literacy in terms of a narrower definition of cognitive skill—the ability to acquire and understand basic health information (e.g., Berkman et al. 2011, Bostock and Steptoe 2012, Murray et al. 2011).

From this perspective, cognitive skills affect mortality for two main reasons. First, people with higher levels of cognitive skills get better jobs and enjoy higher incomes even within levels of educational attainment; these resources in turn affect health and mortality. Second, people with higher levels of cognitive skills are better able to obtain and process information that is beneficial to their health and longevity (Gottfredson 2004, Hart et al. 2004, Hart et al. 2005, Link et al. 2008)—regardless of how far they go in school. Seeking out and understanding information about avoiding or curing diseases; comprehending and processing doctor's instructions; and anticipating health risks all require cognitive skill.

Among people older than the High School and Beyond cohort, for example, Punthakee et al. (2012) showed that among people with Type 2 diabetes those with low cognitive functioning are at higher risk of hypoglycemia because of the cognitive demands associated with performing home glucose monitoring and adjusting medications. Among people the age of our cohort, cognitive skill may (for example) help people better comprehend and process information related to effectively taking pharmaceuticals related to mental health problems. From these points of view, educational attainment is an imperfect proxy for all aspects of education that matter for health and mortality. To measure cognitive skills more directly, researchers rely on measures of characteristics like IQ, abstract reasoning ability, or academic achievement; these measures tap into very different dimensions of cognitive skill but are highly correlated.

Education as Exposure to Knowledge

A core activity of formal schooling is taking courses in different subjects at each grade level to build a base of knowledge. However, opportunities to acquire that knowledge are stratified in American schools. Mathematics and science courses are most stratified because more advanced courses involve prerequisite knowledge gained cumulatively in prior courses. More advanced courses typically build toward knowledge of analytic and abstract concepts that better prepare students to continue to learn whereas less advanced courses expose students to remedial or more concrete concepts. In contrast to these general schooling experiences that involve exposure to knowledge, health research often emphasizes the importance of health knowledge—the possession of specific pieces of information that can protect health—for morbidity and mortality (e.g., Hazuda et al. 1983, Kenkel 1991).

According to this view, exposure to knowledge can affect mortality in at least two ways. First, regardless of their educational attainment or their general ability to obtain and process information, people with exposure to abstract concepts are likely to be able to tackle problems and apply analytic principles to new challenges. On the other end of the continuum, individuals who have had limited exposure to abstraction in approaching analytic problems—because they have only been exposed to the lower levels of coursework—may be less equipped to tackle new challenges. Second, people benefit from exposure to knowledge about how to avoid or cure disease, how biological processes work, and how health risks can be avoided. For example, Nayga (2000) showed that people with knowledge of the factors that contribute to obesity are less likely to be obese. Course taking in high school provides important indicators of exposure to abstract concepts and knowledge. An important indicator of exposure to general principles of analytic knowledge and abstraction is completion of advanced mathematics coursework; indeed, previous work has shown that advanced mathematics coursework predicts health outcomes (Carroll et al. 2017). People who have taken more science, health, and related courses have presumably had greater exposure to concepts related to preventing and curing disease.

Education as Non-Cognitive Skill

Other studies emphasize the non-cognitive skills that are associated with education. Social psychological characteristics like self-esteem, grit, conscientiousness, and locus of control have all been linked to morbidity and mortality (e.g., King et al. 2010, Ross et al. 2013, Sheffer et al. 2012); these effects may operate through well-documented impacts of non-cognitive skills on later-life economic and social well-being (Heckman, Stixrud and Urzua 2006, Heckman et al. 2010). For example, King et al. (2010) found a relationship between self-efficacy and people's ability to successfully manage diabetes-related behaviors. Non-cognitive skills like self-esteem and locus of control may also be related to risk of death from causes more common in High School and Beyond like accidental drug overdoses and suicide. In short, people with self-control, determination, and the ability to act effectively within a highly bureaucratic world are better able to avoid health risks and to seek out and act on things that benefit their health and aid their longevity. There are well-developed scales designed to measure self-esteem, locus of control, self-efficacy, grit, and other dimensions of non-cognitive skills. All are only imperfectly associated with educational attainment, levels of cognitive skills, and course-taking patterns. Among people with the same level of completed schooling, equivalent cognitive skills, and the same exposure to abstract concepts and knowledge, those with more non-cognitive skills may thus be more likely to survive.

Education as Social Network Membership

American secondary and post-secondary schools are highly stratified by socioeconomic status and race/ethnicity. Recent scholarship suggests that the attributes of social networks in schools and elsewhere—and perhaps especially the healthiness and health behaviors of close network ties—can have consequences for people's own health and well-being (e.g., Berkman 1995, Kawachi, Kennedy and Glass 1999, Menendez-Villalva et al. 2015, Novak, Suzuki and Kawachi 2015, Pinquart and Duberstein 2010, Reeves et al. 2014, Smith and Christakis 2008, Umberson, Crosnoe and Reczek 2010). People are influenced by school peers in ways that may benefit or harm their health (Abrutyn and Mueller 2014, Mueller et al. 2010, Mueller and Abrutyn 2015); likewise, peers can provide resources, information, or social norms that may hinder or enhance health. What may matter about education, then, is not what skills people have or how far they persist in school. It may be that the school-based sorting of people into more or less advantaged social networks is what matters about education. From this perspective, researchers seek to measure the attributes, behaviors, and network connections of classmates, schoolmates, and friends.

Educational attainment, cognitive skills, non-cognitive skills, exposure to knowledge, and access to advantaged social networks are empirically correlated with one another (Clouston et al. 2015, Herd 2010). Given these interrelationships, what are the consequences of focusing exclusively on measures of educational attainment in research on early adult mortality gradients? Given the interrelationships among these aspects of education, how might our understanding of early mortality gradients be obscured by relying exclusively on a single measure of educational attainment?

In Figure 1, we depict the relationships among educational attainment, mortality, cognitive skills, non-cognitive skills, exposure to knowledge, and social networks; the latter are measured in both *adolescence* (prior to completion of formal schooling) and in *young adulthood* (after most people have completed their formal schooling). In the diagram, we posit that educational attainment is affected by people's cognitive and non-cognitive skills, their exposure to knowledge, and membership in social networks—all as measured in *adolescence*. There are extensive literatures (e.g., Heckman, Stixrud and Urzua 2006, Jencks et al. 1972) demonstrating that how far people go in school depends in part on these four things. Figure 1 next stipulates that educational attainment—measured as years of schooling completed or degrees attained—affects people's cognitive and non-cognitive skills, their exposure to knowledge, and attributes of their social networks—all as measured in *young adulthood*. Additional formal schooling imparts skills and knowledge, shapes people's personalities, and exposes them to new social networks.

Finally, Figure 1 supposes that educational attainment, cognitive and non-cognitive skills, exposure to knowledge, and attributes of social networks all affect mortality risk. A key feature of Figure 1 is that *adolescent* skills, exposure to knowledge, and social networks have no direct causal effect on mortality; they influence mortality only through their influence on educational attainment. If this model holds, what does this imply about the validity of results from analyses that rely exclusively on measures of educational attainment in research on mortality gradients? And what does it tell us about which aspects of education matter for mortality?

If the model in Figure 1 is correct, then analyses of mortality gradients that (1) begin by estimating the effects of highest degree (or years of schooling) completed on mortality risk and (2) exclude measures of cognitive skills, non-cognitive skills, exposure to knowledge, or social networks come to unbiased results. (Of course, omitting measures of possible confounders like family socioeconomic background may be problematic, but that is a different issue). All aspects of *adolescent* schooling get wrapped up in the measure of educational attainment; *adolescent* measures of cognitive skills, non-cognitive skills, exposure to knowledge, or social networks do not confound the relationship between educational attainment and mortality. All aspects of *adult* cognitive skills, non-cognitive skills, exposure to knowledge, or social networks are simply mechanisms or causal pathways through which educational attainment affects early mortality risk. In this case, educational attainment captures all of these dimensions of education and so analyses relying exclusively on measures of educational attainment come to unbiased conclusions (again, providing that other confounders are considered and that the model is otherwise specified correctly). If the model in Figure 1 is correct, this is good news for those who have previously studied educational gradients in early mortality using data that do not include measures of these other aspects of education. And, it implies something important about *how* education affects early mortality: It suggest that *adolescent* skills, personality, and social networks only matter for early mortality because they shape educational attainment, and that educational attainment affects early mortality at least partly via its impact on *adult* skills, personality, and social networks.

But what if the model in Figure 2 is accurate? Here, *adolescent* measures of cognitive skills, non-cognitive skills, exposure to knowledge, or social networks have effects on mortality that do not operate exclusively through educational attainment. That is, net of educational attainment, people with more skills or exposure to knowledge or more advantageous social networks in adolescence have lower mortality risks. Herd (2010) and Duke and Macmillan (2016) drew such conclusions about the effects of cognitive and non-cognitive skills on a variety of self-reported health outcomes net of educational attainment; neither considered mortality as a dependent variable. If the model in Figure 2 is correct, then the association between educational attainment and young adult mortality is confounded by these antecedents of educational attainment. Results from analyses that represent education using only measures of educational attainment are thus potentially biased because of the confounding influence of other aspects of education.

Alternatively, what if the model in Figure 3 is correct? In this model, *adolescent* measures of cognitive skills, non-cognitive skills, exposure to knowledge, or social networks have no direct effects on mortality but they do directly affect their counterparts in adulthood. For example, cognitive skills in adolescence do not directly affect early mortality risk, but they do directly affect cognitive skills in young adulthood; not all the latter effect operates through educational attainment. In this example, among people with the same level of completed schooling, people with greater cognitive skill as adolescents will have increased cognitive skill in adulthood. If the model in Figure 3 is correct, then it is also true that the association between educational attainment and mortality risk is confounded by these other antecedents and consequences of educational attainment. However, if cognitive skills (for example) are largely stable within people's lives, then the model in Figure 3 will not hold.

Our empirical question boils down to this: Which of the models in Figures 1 through 3 is best supported by the data? If the model in Figure 1 is supported, then results based on analyses that use only measures of educational attainment are unbiased by the omission of measures of cognitive skills, non-cognitive skills, and exposure to knowledge and social networks. If the models in either Figure 2 or Figure 3 are supported, then analyses that rely exclusively on measures of educational attainment are potentially biased. Whichever model holds, we have learned something important about which aspects of education matter for early mortality.

Fortunately, the decision about whether the model in Figure 1 is supported can be based on a relatively simple empirical test. Net of educational attainment, are there independent effects of *adolescent* measures of cognitive skill, non-cognitive skills, exposure to knowledge, or aspects of social networks on adult mortality risk by age 50? If so, then the model in Figure 1 is open to question and we should be concerned about the validity of the results from many prior analyses. If there are no such independent effects, then this suggests that the model in Figure 1 is well supported and that models of the effects of standard indicators of educational attainment on young adult mortality are not biased by the omission of these measures.

Beyond assessing our key question about potential biases in analyses of the effects of educational attainment on mortality, the empirical test above also says something substantive about the processes through which education affects young adult mortality. Does additional schooling causally affect early mortality, or is it (at least partly) a proxy for something else? In trying to understand mortality differentials by education, should we be seeking to understand what it is about additional schooling that changes within people and that may affect their health and longevity? Furthermore, the empirical test above will say something about the likely efficacy for improving health and longevity of social policies designed to promote additional schooling. To the extent that educational attainment is endogenous to previously existing skills and increases the variance of skills among those who complete higher levels of education, then education may *increase* inequality in health and mortality. On the other hand, to the extent that educational attainment increases mean levels of skills, and to the extent that education impacts long-run health and mortality risk above and beyond its contribution to the measured mediating factors discussed above, education may enhance population health and, potentially, reduce health disparities among those who attain higher levels of education.

RESEARCH DESIGN

A random subset of 14,830[1] sophomores and 12,000 seniors were re-surveyed in 1982, 1984, 1986, and (for sophomores) 1992. All follow-ups gathered information about cohort members' educational, employment, and family activities and transitions. The 1982 re-interview featured a second round of cognitive tests and gathered secondary school transcripts.

HS&B sophomores and seniors were again re-interviewed in 2014 and 2015, respectively, when most were in their early 50s (Muller et al. 2019a, Muller et al. 2019b). The 2014–15 surveys gathered information about work, family, and health at mid-life. In preparation for the 2014–15 surveys, identifying information about sample members (e.g., Social Security numbers, birthdates, names) was used to determine which cohort members were dead; other cohort members who were deceased were identified during fieldwork. Just more than 1,000 sample members were deceased by 2014–15.

We require information about aspects of cohort members' educational attainments, cognitive and non-cognitive skills, exposure to knowledge, school social contexts, and measures likely to confound associations between education and mortality. We thus limit our sample to the 22,720 cohort members—about 85% of the 26,830 members of the longitudinal panel—who participated in both the 1980 and 1986 student surveys (and who thus survived to at least 1986). The latter condition, which effectively limits the age range within which sophomores/ seniors are at risk of mortality to 22/24 through 50/52, is necessary for observing key independent variables prior to assessment of survival status. All measures are described in Table 1, separately by mortality status in 2014–15.

Mortality

HS&B cohort members' mortality status is ascertained via links to both the Social Security Death Master File and the National Death Index as well as supplementary information from internet searches, genealogical websites, credit bureau databases, and online obituaries. As described by Warren et al (2017), our measure probably modestly underestimates the number of deceased sample members.

[1]All of our sample sizes have been rounded to the nearest 10 in compliance with the terms of our restricted use data agreement with the National Center for Education Statistics (NCES). NCES has conducted a disclosure review and approved this manuscript for public distribution.

Educational attainment

Information about educational attainment comes from survey data through 1992 surveys and from secondary and post-secondary transcripts. We rely only on measures of highest degree completed; results using years of schooling completed are quite similar (and are available upon request). As shown in Table 1, about 4% of the cohort did not complete high school and about 12% completed at least a bachelor's degree; this relatively low percentage of bachelor's degree holders (compared to national estimates from this cohort) is because educational attainment was obtained via transcript measures which only go through the early 1990s (and are thus less complete for seniors).

Cognitive skills

HS&B panelists completed standardized achievement tests in several subjects in both 1980 and 1982. The base year math test consisted of 38 items designed to measure students' skills in basic numeracy, algebra and geometry (Rock et al. 1985).

Non-cognitive skills

HS&B includes several measures of panelists' non-cognitive skills. We consider individuals' locus of control and self-esteem. We also condition on self-reported measures from 1980 of how often they were late for class, how often they skipped class, how often they faced disciplinary problems in school, and whether they experienced trouble with the law.

Exposure to knowledge

Mathematics coursework is the best indicator of exposure to abstract and analytic knowledge (Carroll and Muller 2018). As shown in Table 1, about 1 in 4 individuals did not complete Algebra I but about 1 in 4 completed trigonometry or calculus.

School social contexts

We characterize the attributes of sample members' secondary school social contexts with respect to each panelist's high school same-grade best friend's academic orientation, the % African American in their school, the % Hispanic in their school, the % of students in their school who planned to attend college, an index of items reflecting problems in each person's school, and the % economically disadvantaged in their school.

Background measures

Because family socioeconomic background and childhood health may confound associations between education (however conceptualized or measured) and adult mortality (Hummer and Hernandez 2013), we include indicators of each panelist's: mother's and father's educational attainment, family income, co-residence with both parents in 1980, number of siblings, nativity, urban/suburban/rural residence, overweight status in 1980, disability status, physical or mental conditions that limited their activities in 1980, and depressive symptoms.

There is relatively little missing data on any of the measures described above; we have no missing data on the mortality status of cohort members. Consequently, we have imputed missing values on all independent variables using chained equations as implemented in

Stata's ICE routine (Royston, Carlin and White 2009, Royston and White 2011). We imputed 20 datasets. Note also that all analyses are weighted by HS&B panel sampling weight and standard errors account for the school-based clustered design of the HS&B sample.

RESULTS

In Table 2 we report results from a series of Cox proportional hazard models of the timing of cohort members' mortality as of 2014–15. All models in Table 2 adjust for the social background and childhood health measures described in Table 1. Model 1 reports coefficients for highest degree completed. As expected, we find that individuals' highest level of completed schooling as of the early 1990s is strongly associated with their risk of death by 2014–15. This finding also holds in separate models (not shown) in which we express education in terms of years of schooling completed. Adjusting for the set of family background and health covariates presented in Table 1 modestly attenuates the educational attainment coefficients, suggesting that the zero-order association between educational attainment and mortality is partially confounded.

In Models 2 through 5—which also all control for the demographic, socioeconomic background, and childhood health measures described in Table 1—we find that mortality is also associated with cognitive skills, non-cognitive skills, exposure to knowledge, and one measure of school social contexts. HS&B panelists' risk of death by 2014–15 is higher if they had lower math test scores, an external locus of control, more days absent in high school, less completed math coursework in high school, or less academically oriented high school friends.

In Model 6, we include all the measures of education and skills, in addition to educational attainment. Here, we find that HS&B panelists' highest level of completed schooling remains independently associated with the risk of death by 2014–15. However, net of highest degree completed, other aspects of education are significantly associated with young adult mortality. Among panelists with the same level of completed schooling, those with fewer absences and those who completed advanced math courses were at reduced risk of death.

Below each model in Table 2 we report fit statistics. A comparison of BIC statistics indicates that all the models that include cognitive skills, non-cognitive skills, and school social networks fit worse than models that do not. So, in Model 7, we estimate a model that only includes educational attainment and math course taking from among the education measures. Two comparisons of model fit are worth highlighting. First, Model 7 (with just attainment and math course taking) fits better according to BIC than Model 6 (with all of the measures of education); this suggests again that including measures of cognitive skills, non-cognitive skills, and school social networks detracts from the fit of the model. Second, and more importantly, Model 7 fits better than Model 1 (which just includes attainment). This indicates that—in contrast to Figure 1—math course taking significantly improves fit relative to a model that only includes attainment.

We should not presume that our results pertain equally to people from all demographic subgroups; there are notable differences across such groups in both educational opportunities/experiences and health outcomes. In Table 3 we re-estimate Model 6—the model that includes educational attainment and the other aspects of skills and education—separately for men, women, whites, and blacks. (The size of our sample of Latinx people is not sufficient to sustain separate analyses; furthermore, the group of Latinx individuals in our sample is very diverse.) The general pattern described above holds for all but blacks. That is, for men, women, and whites, both educational attainment and other aspects of education are independently associated with risk of mortality by 2014–15. For each of those three groups, risk of mortality is lower among those with more completed schooling and more completed math coursework. Among men and whites, more school absences are independently associated with higher risk of mortality. We suspect the anomalous finding for blacks—for whom no aspect of education is significantly associated with mortality risk—may result from a lack of statistical power. As shown in Table 1, only 10% of the sample is African American and there are only about 140 deceased African American panelists.

DISCUSSION

The empirical association between mortality risk and educational attainment is well established—although it has not often been the object of study for many sociologists of education or other education researchers. Unfortunately, researchers in other fields like medical sociology, public health, demography, and economics rarely consider any dimensions of education beyond attainment in their analyses of educational gradients in mortality. That is, they rarely draw on education researchers' rich and well-developed theories and ideas about the complex interrelationships between schooling processes, skills, social contexts, and educational attainments. An overarching goal of our research has been to make the case for expanding education researchers' scope of focus to include mortality as a key outcome of education and schooling. Another has been to enrich mortality researchers' conceptualizations and measurement of education based on theory and empirical work that appears in journals like this one.

Do cognitive and non-cognitive skills, course taking, and school social contexts matter for young adult mortality beyond their association with educational attainment? If so, then this raises important concerns about the validity and completeness of research on mortality gradients that relies exclusively on measures of educational attainment. In that research, estimates of the effects of educational attainment on mortality may be biased because of analysts' inability to account for confounding due to these other aspects of education.

In part, our research questions are about measurement: In research on mortality gradients, is it enough to simply measure educational attainment to the exclusion of other aspects of education and skills? In part, however, our questions are also more broadly about the nature of educational (and more broadly, social and economic) gradients in mortality. Along which social, psychological, institutional, or cognitive dimensions do inequalities in mortality arise? Do gradients in mortality have to do with skills, the opportunity to learn provided by schools, exposure to social contexts, or degree completion? In turn, our questions then have implications for how to address social inequalities in mortality. If all that matters for early adult mortality is how long people persist in school or what degree they attain, then social policies designed (for example) to increase access to post-secondary schooling and to improve rates of post-secondary completion may also be effective health policies that may reduce mortality gradients down the road.

Our empirical results indicate that the effects of many of our measures of cognitive skills, non-cognitive skills, exposure to knowledge, and social contexts on mortality risk between the ages of 22/24 and 50/52 are indirect, operating through educational attainment. These antecedents of educational attainment are significantly associated with mortality. However, many of these attributes and exposures matter for mortality risk through their influence on attainment. This does not imply that these aspects of cognitive skills, non-cognitive skills, exposure to knowledge, and social networks have no effect on mortality. They do, but they matter for early adult mortality through a common intervening mechanism: education attainment.

At the same time, other dimensions of education are associated with young adult mortality even net of educational attainment and a robust set of controls for factors that might confound associations between education and mortality. This suggests that these opportunities and achievements may have effects on mortality that do not operate through educational attainment. In the full sample and for men, women, and whites, mathematics coursework is associated with early adult mortality net of educational attainment. People who fail to complete advanced mathematics coursework when they are young are at markedly high risk of early adult death, even among people with the same level of completed schooling.

These effects of mathematics coursework may operate in several ways; we cannot adjudicate among them given the data in hand. For example, young people who only took lower level mathematics courses may not have learned to think analytically or abstractly in ways that are consequential for longevity. On the other hand, a student's failure to advance far in the mathematics curriculum may reflect underlying health or cognitive or non-cognitive skills not captured by our measured control variables; such unmeasured factors would also likely confound associations between educational attainment and mortality. In any case, there appear to be early adult mortality returns to increased mathematics course-taking even among people with the same level of completed schooling.

Three limitations of our work point to profitable directions for future research. First, members of our cohort persisted in school to at least 10th grade and have only reached their early 50s. Rates of young adult mortality are thus relatively low in our sample and causes of death are different than in later life. We look forward to extending our analyses in the future when the cohort is older. Second, our sample is not large enough to produce reliable estimates for African Americans, for Latinx, or for separate sex-by-race subgroups. Future research based on larger samples might investigate group differences in our basic findings and/or in how these aspects of education are related to different causes of adult mortality. Third, we do not assess or model the mechanisms or pathways through which educational attainment or mathematics coursework impact mortality. It is beyond the scope of this paper to consider the cognitive, socioeconomic, labor market, biological, and other pathways through these effects might arise.

Our results have implications for how we evaluate research on education and mortality that has relied exclusively on measures of educational attainment. More importantly, they have implications for how we think about educational disparities in mortality and what to do about them. Increasing young people's educational attainment—encouraging them to complete high school, enroll in college, and/or get a college degree—may matter for reducing adult mortality risk and be a very important health policy option (Schoeni et al. 2008). However, other efficacious policy options—and ones over which we may conceivably have greater control—may be to ensure that young people have access to and complete advanced mathematics coursework while in high school.

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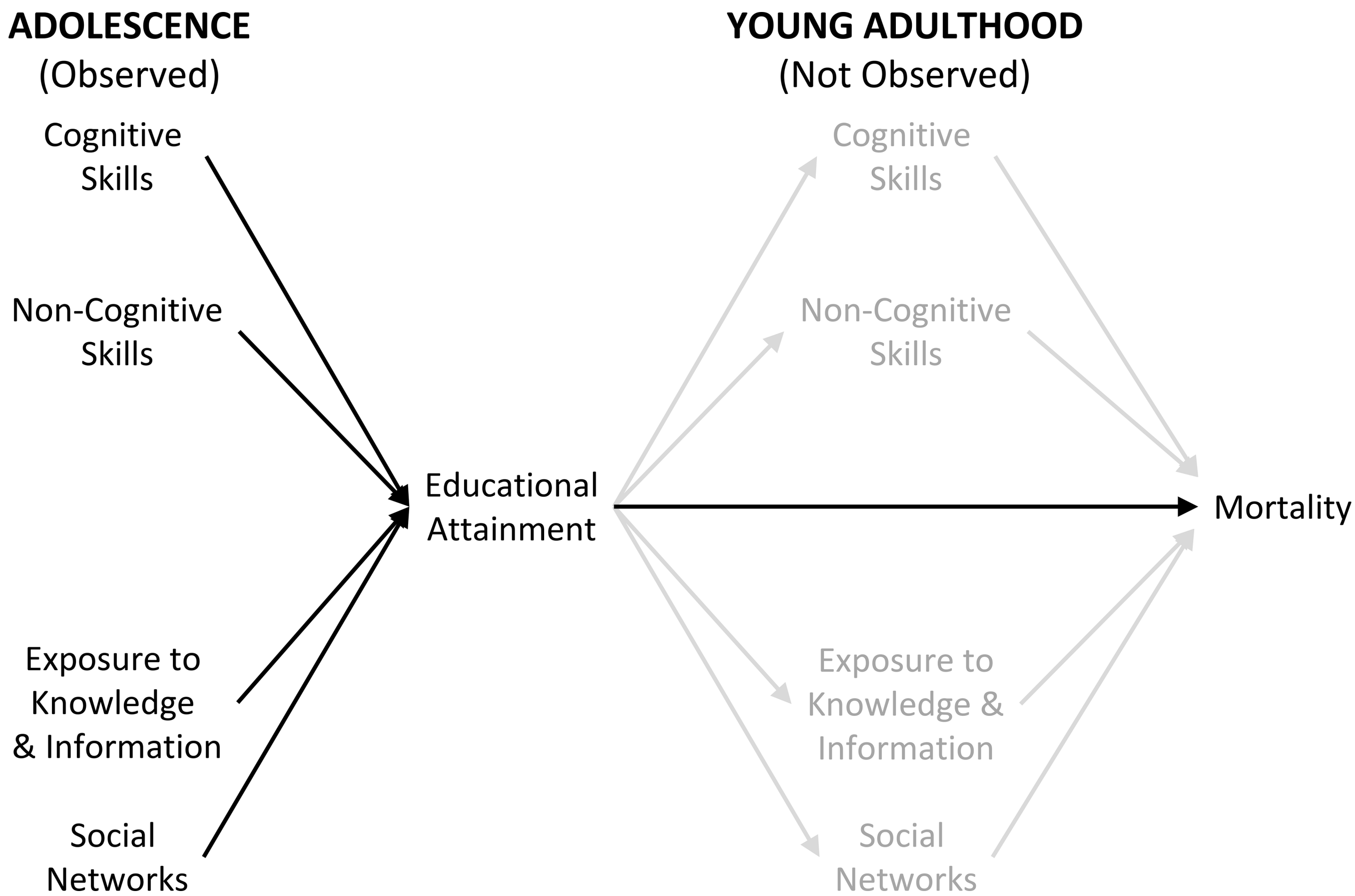

Figure 1.
Heuristic Diagram of Relationships Among Educational Attainment, Skills, Knowledge, Networks, and Mortality

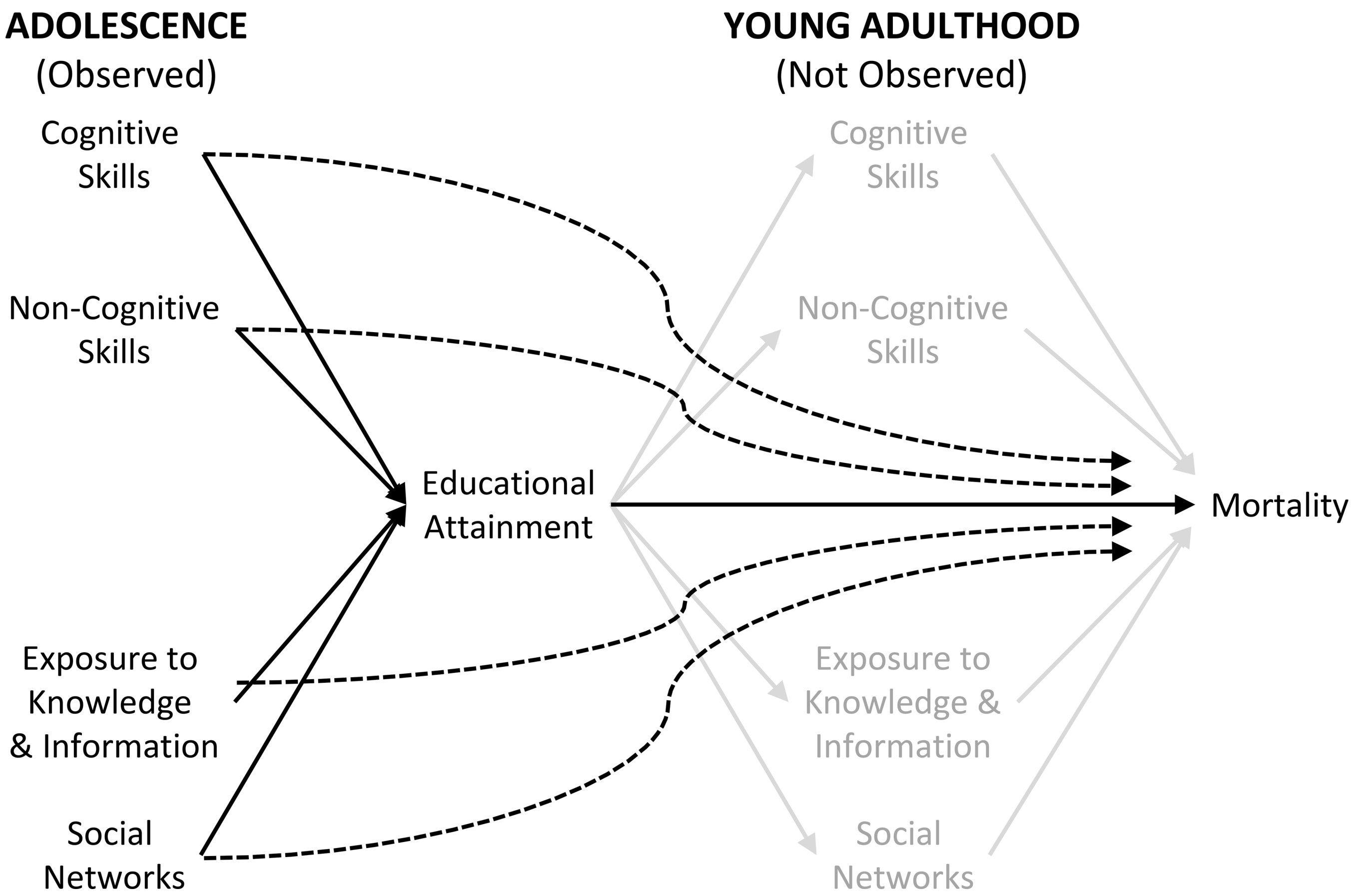

Figure 2.

Heuristic Diagram of Relationships Among Educational Attainment, Skills, Knowledge, Networks, and Mortality: Lagged Effects Scenario 1

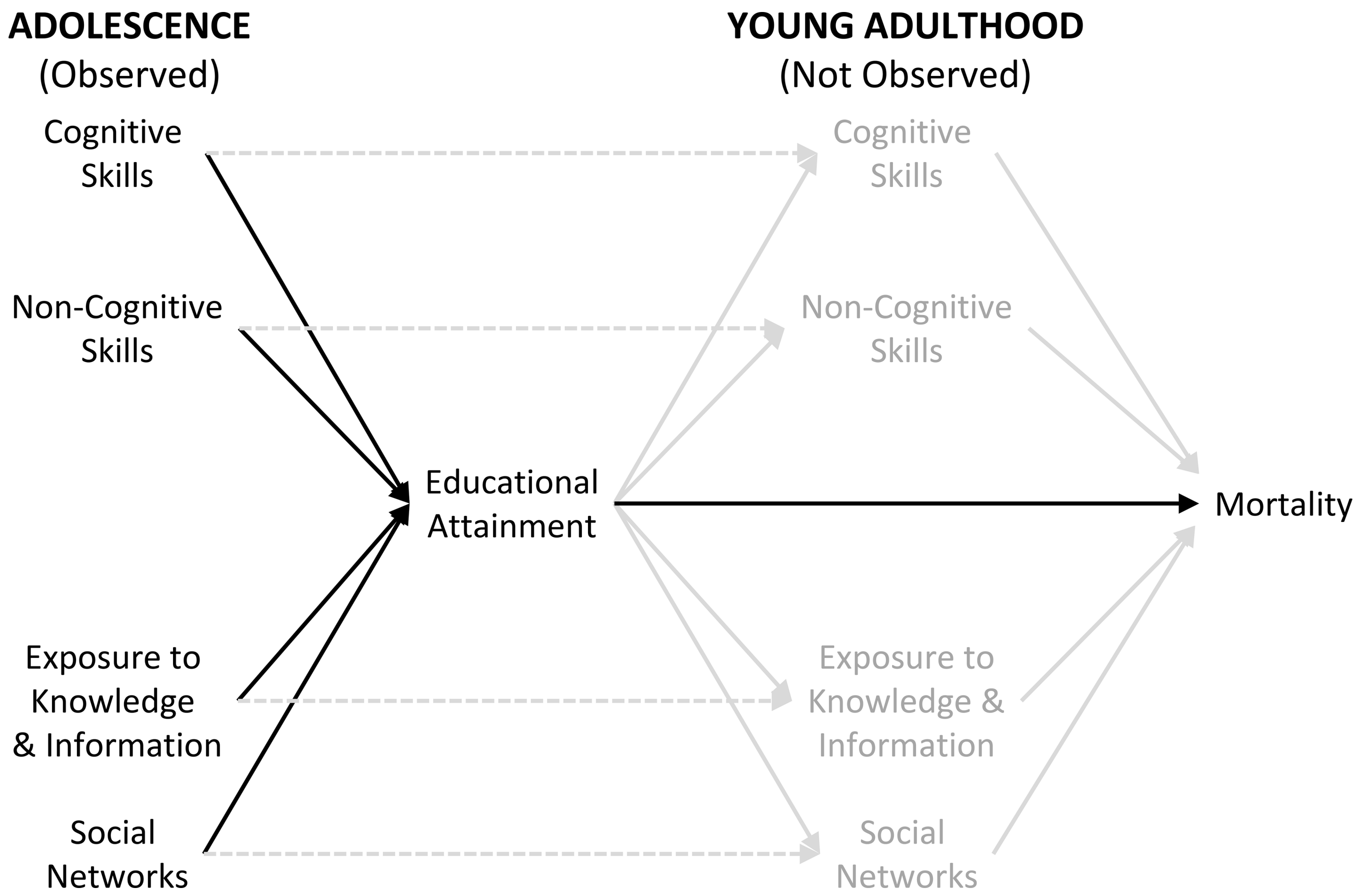

Figure 3.
Heuristic Diagram of Relationships Among Educational Attainment, Skills, Knowledge, Networks, and Mortality: Lagged Effects Scenario 2

TABLE 1.

Descriptive Statistics, by Mortality Status

	Survived (n=21,670)		Died (n=1,040)		Full Sample (n=22,720)	
	% or Mean	(SD)	% or Mean	(SD)	% or Mean	(SD)
Educational Attainment						
Less than High School	4.1%		9.4%		4.3%	
High School Only	68.0%		70.6%		68.1%	
Some College, No Deg.	15.1%		14.0%		15.1%	
Bachelor’s Degree	12.9%		6.1%		12.5%	
Cognitive Skills: Math Test Score	50.52	(9.92)	47.77	(10.11)	50.39	(9.93)
Non-Cognitive Skills						
Self Concept	0.01	(0.73)	0.08	(0.79)	0.01	(0.73)
Locus of Control	0.01	(0.65)	−0.07	(0.70)	0.01	(0.65)
Days Absent from School	3.13	(4.32)	4.19	(5.29)	3.17	(4.36)
Days Tardy for Class	2.75	(4.44)	3.21	(4.92)	2.77	(4.47)
Discipline Problems						
No	77.4%		69.3%		77.1%	
Yes	22.6%		30.8%		22.9%	
Trouble with the Law						
No	95.3%		93.0%		95.2%	
Yes	4.7%		7.0%		4.8%	
Exposure to Knowledge: Math Coursework						
Less than Algebra I	25.5%		42.4%		26.3%	
Algebra I	15.5%		15.4%		15.5%	
Algebra II/Geometry	34.2%		25.0%		33.7%	
Trig./Calculus	24.8%		17.2%		24.5%	
School Social Contexts						
Best Friend’s Acad. Orientation	−0.05	(0.71)	−0.17	(0.73)	−0.05	(0.71)
% Black in School	11.79	(20.30)	15.15	(22.75)	11.94	(20.42)
% Hispanic in School	4.37	(10.57)	4.38	(10.45)	4.37	(10.56)
% College Going in School	46.62	(20.75)	45.30	(20.44)	46.56	(20.73)
School Problems Index	−0.02	(0.56)	0.02	(0.55)	−0.02	(0.56)
% Disadvantaged in School	13.98	(17.34)	16.73	(19.98)	14.11	(17.46)
Social Background and Childhood Health						
Gender						
Female	52.8%		36.7%		52.0%	
Male	47.2%		63.3%		48.0%	
Race/Ethnicity						
Non-Hispanic White	83.2%		78.5%		83.0%	
Non-Hispanic Black	9.8%		14.8%		10.0%	
Hispanic	4.8%		4.1%		4.8%	
Non-Hispanic Other	2.2%		2.6%		2.2%	

	Survived (n=21,670)		Died (n=1,040)		Full Sample (n=22,720)	
	% or Mean	(SD)	% or Mean	(SD)	% or Mean	(SD)
Father's Education						
Less than High School	21.0%		25.0%		21.2%	
High School Only	28.6%		24.6%		28.4%	
Some College, No Deg.	17.4%		18.7%		17.5%	
Bachelor's Degree	33.0%		31.7%		33.0%	
Mother's Education						
Less than High School	18.2%		23.9%		18.5%	
High School Only	44.6%		45.8%		44.7%	
Some College, No Deg.	23.1%		19.3%		22.9%	
Bachelor's Degree	14.1%		11.1%		14.0%	
Family Income						
Lowest Third	17.7%		22.4%		17.9%	
Middle Third	39.3%		35.2%		39.1%	
Highest Third	43.0%		42.4%		42.9%	
Childhood Family Structure						
Not Two Parents	28.0%		36.4%		28.4%	
Two Parents	72.0%		63.7%		71.6%	
Number of Siblings	2.83	(1.74)	3.01	(1.83)	2.84	(1.75)
BMI Category in Childhood						
Underweight	6.2%		5.2%		6.2%	
Normal Weight	79.9%		74.0%		79.6%	
Overweight	9.7%		13.2%		9.9%	
Obese	4.2%		7.6%		4.3%	
Health Limitation in Childhood						
No	93.2%		91.1%		93.1%	
Yes	6.8%		9.0%		6.9%	
Disability in Childhood						
No	88.1%		80.5%		87.7%	
Yes	12.0%		19.5%		12.3%	
Depression in Childhood						
Lowest Quartile	26.1%		23.1%		25.9%	
	19.5%		18.9%		19.5%	
	30.3%		28.9%		30.3%	
Highest Quartile	24.1%		29.1%		24.3%	
Immigrant						
Native Born	96.4%		98.1%		96.5%	
Foreign Born	3.6%		1.9%		3.5%	
Urbanicity						
Urban	18.5%		20.7%		18.6%	
Suburban	49.5%		47.3%		49.4%	
Rural	32.0%		32.1%		32.0%	

Note: Sample includes the 12,570 sophomores and 10,150 seniors who responded to the 1980 and 1986 High School and Beyond surveys. Note that sample sizes are rounded to the nearest 10 due to NCES data disclosure policies. Missing values have been imputed using chained equations. Analyses are weighted by RAWWT.

TABLE 2.

Cox Proportional Hazard Estimates of the Effects of Education, Cogniitive and Noncogniitve Skills, Coursetaking, and Social Context on Early Mortality

	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6			Model 7		
	Coef.	**Haz.**	**95% C.I.**	**Coef.**	**Haz.**	**95% C.I.**	**Coef.**	**Haz.**	**95% C.I.**	**Coef.**	**Haz.**	**95% C.I.**	**Coef.**	**Haz.**	**95% C.I.**	**Coef.**	**Haz.**	**95% C.I.**	**Coef.**	**Haz.**	**95% C.I.**
Educational Attainment																					
Less than High School		[Reference]				---			---			---			---		[Reference]			[Reference]	
High School Only	−0.65	0.52	−0.86 – −0.44 [a]			---			---			---			---	−0.37	0.69	−0.59 – −0.16 [a]	−0.46	0.63	−0.67 – −0.24 [a]
Some College, No Degree	−0.64	0.53	−0.90 – −0.39 [a]			---			---			---			---	−0.35	0.71	−0.61 – −0.08 [b]	−0.43	0.65	−0.69 – −0.17 [a]
BA or more	−1.22	0.30	−1.54 – −0.90 [a]			---			---			---			---	−0.79	0.46	−1.13 – −0.44 [a]	−0.90	0.41	−1.24 – −0.56 [a]
Cognitive Skills: Math Test Score			---	−0.02	0.98	−0.03 – −0.01 [a]			---			---			---	0.00	1.00	−0.01 – 0.01			---
Non-Cognitive Skills																					
Self Concept			---			---	0.03	1.03	−0.06 – 0.11			---			---	0.00	1.00	−0.08 – 0.09			---
Locus of Control			---			---	−0.10	0.90	−0.20 – 0.00 [b]			---			---	−0.02	0.98	−0.13 – 0.08			---
Days Absent from School			---			---	0.03	1.03	0.01 – 0.04 [a]			---			---	0.02	1.02	0.00 – 0.03 [b]			---
Days Tardy for Class			---			---	0.00	1.00	−0.01 – 0.01			---			---	0.00	1.00	−0.01 – 0.01			---
Discipline Problems (vs. Not)			---			---	0.14	1.16	0.00 – 0.29			---			---	0.04	1.04	−0.11 – 0.19			---
Trouble w/ the Law (vs Not)			---			---	0.07	1.07	−0.18 – 0.32			---			---	0.01	1.01	−0.24 – 0.26			---
Exposure to Knowledge: Math Coursework																					
Less than Algebra I			---			---			---		[Reference]				---		[Reference]			[Reference]	

	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6			Model 7		
	Coef.	Haz.	95% C.I.	Coef.	Haz.	95% C.I.	Coef.	Haz.	95% C.I.	Coef.	Haz.	95% C.I.	Coef.	Haz.	95% C.I.	Coef.	Haz.	95% C.I.	Coef.	Haz.	95% C.I.
Algebra I			---			---			---	−0.28	0.75	−0.47 – −0.10 [a]			---	−0.17	0.84	−0.36 – 0.02	−0.20	0.82	−0.38 – −0.01 [b]
Algebra II/ Geometry			---			---			---	−0.51	0.60	−0.68 – −0.35 [a]			---	−0.35	0.70	−0.54 – −0.16 [a]	−0.40	0.67	−0.58 – −0.23 [a]
Trig./ Calculus			---			---			---	−0.63	0.53	−0.82 – −0.44 [a]			---	−0.37	0.69	−0.61 – −0.13 [a]	−0.46	0.63	−0.66 – −0.25 [a]
School Social Contexts																					
Best Friend's Acad. Orientation			---			---			---			---	−0.14	0.87	−0.22 – −0.05 [a]	−0.03	0.97	−0.12 – 0.05			---
% Black in School			---			---			---			---	0.00	1.00	0.00 – 0.01	0.00	1.00	0.00 – 0.01			---
% Hispanic in School			---			---			---			---	0.00	1.00	0.00 – 0.00	0.00	1.00	0.00 – 0.00			---
% College Going in School			---			---			---			---	0.00	1.00	−0.01 – 0.00	0.00	1.00	0.00 – 0.00			---
School Problems Index			---			---			---			---	−0.07	0.93	−0.19 – 0.05	−0.09	0.92	−0.20 – 0.03			---
% Disadvantaged in School			---			---			---			---	0.00	1.00	0.00 – 0.01	0.00	1.00	0.00 – 0.01			---
N			22,716			22,716			22,716			22,716			22,716			22,716			22,716
Log likelihood			−10,257.4			−10,272.3			−10,268.8			−10,256.5			−10,274.0			−10,233.1			−10,242.8
BIC			20,717.5			20,733.1			20,761.2			20,715.6			20,771.6			20,780.5			20,709.1

Note: Sample includes the 12,570 sophomores and 10,150 seniors who responded to the 1980 and 1986 High School and Beyond surveys. Note that sample sizes are rounded to the nearest 10 due to NCES data disclosure policies. All models except Model 0 include the full set of demographic, social background, and childhood health measures described in Table 1. Missing values on independent variables have been imputed using chained equations. Analyses are weighted by RAWWT, and standard errors account for school-level clustering.

[a] $P<0.01$

[b] $P<0.05$

Table 3.

Cox Proportional-Hazard Estimates of the Effects of Education, Cognitive and Noncognitive Skills, Course Taking, and Social Context on Early Mortality, by Gender and Race/Ethnicity.

	Men			Women			Whites			Blacks		
	Coefficient	**Hazard**	**95% CI**	**Coefficient**	**Hazard**	**95% CI**	**Coefficient**	**Hazard**	**95% CI**	**Coefficient**	**Hazard**	**95% CI**
Educational attainment												
Less than high school		[Reference]			[Reference]			[Reference]			[Reference]	
High school only	−0.27	0.76	−0.55 to 0.01	−0.55	0.58	−0.92 to −0.18**	−0.29	0.75	−0.60 to 0.03	−0.33	0.72	−0.75 to 0.08
Some college, no degree	−0.23	0.79	−0.57 to 0.11	−0.53	0.59	−0.98 to −0.08*	−0.47	0.63	−0.87 to −0.06*	−0.29	0.75	−0.79 to 0.21
BA or more	−0.84	0.43	−1.30 to −0.38**	−0.77	0.46	−1.32 to −0.23**	−0.76	0.47	−1.24 to −0.28**	−0.65	0.52	−1.29 to 0.00
Cognitive skills: math test score	0.00	1.00	−0.02 to 0.01	0.00	1.00	−0.01 to 0.02	0.00	1.00	−0.01 to 0.01	−0.01	0.99	−0.03 to 0.01
Noncognitive skills												
Self-concept	−0.04	0.96	−0.16 to 0.07	0.09	1.09	−0.05 to 0.23	0.08	1.09	−0.03 to 0.20	−0.01	0.99	−0.17 to 0.15
Locus of control	−0.05	0.95	−0.19 to 0.08	0.04	1.04	−0.13 to 0.21	0.01	1.01	−0.14 to 0.17	−0.07	0.93	−0.24 to 0.11
Days absent from school	0.02	1.02	0.01 to 0.04**	0.00	1.00	−0.02 to 0.03	0.02	1.02	0.00 to 0.04*	0.01	1.01	−0.02 to 0.03
Days tardy for class	0.00	1.00	−0.02 to 0.01	0.00	1.00	−0.02 to 0.03	−0.01	0.99	−0.03 to 0.02	0.01	1.01	−0.02 to 0.03
Discipline problems (vs. not)	0.04	1.04	−0.15 to 0.23	0.04	1.04	−0.22 to 0.31	0.10	1.10	−0.11 to 0.31	0.07	1.07	−0.20 to 0.34
Trouble with the law (vs. not)	−0.04	0.96	−0.32 to 0.24	0.28	1.33	−0.33 to 0.90	−0.02	0.98	−0.36 to 0.33	−0.10	0.90	−0.70 to 0.49
Exposure to knowledge: math coursework												
Less than Algebra I		[Reference]			[Reference]			[Reference]			[Reference]	
Algebra I	−0.19	0.82	−0.44 to 0.06	−0.14	0.87	−0.43 to 0.15	−0.31	0.73	−0.59 to −0.03*	0.10	1.11	−0.23 to 0.43
Algebra II/geometry	−0.33	0.72	−0.57 to −0.08**	−0.41	0.66	−0.73 to −0.08*	−0.61	0.54	−0.88 to −0.34**	−0.02	0.98	−0.38 to 0.33
Trigonometry/ calculus	−0.32	0.73	−0.61 to −0.03*	−0.47	0.63	−0.90 to −0.04*	−0.59	0.56	−0.90 to −0.27**	0.09	1.10	−0.35 to 0.54
School social contexts												

	Men			Women			Whites			Blacks		
	Coefficient	**Hazard**	**95% CI**	**Coefficient**	**Hazard**	**95% CI**	**Coefficient**	**Hazard**	**95% CI**	**Coefficient**	**Hazard**	**95% CI**
Best friend's academic orientation	0.00	1.00	−0.11 to 0.11	−0.10	0.90	−0.26 to 0.06	−0.05	0.95	−0.17 to 0.07	0.04	1.04	−0.16 to 0.23
% black in school	0.00	1.00	0.00 to 0.01	0.00	1.00	0.00 to 0.01	0.00	1.00	−0.01 to 0.01	0.00	1.00	0.00 to 0.01
% Hispanic in school	0.00	1.00	0.00 to 0.01	0.00	1.00	−0.01 to 0.01	0.00	1.00	−0.01 to 0.01	0.00	1.00	−0.01 to 0.01
% college going in school	0.00	1.00	−0.01 to 0.00	0.00	1.00	0.00 to 0.01	0.00	1.00	−0.01 to 0.00	0.00	1.00	−0.01 to 0.01
School problems index	−0.08	0.93	−0.22 to 0.06	−0.11	0.90	−0.31 to 0.10	−0.08	0.92	−0.27 to 0.10	−0.11	0.90	−0.30 to 0.08
% disadvantaged in school	0.00	1.00	0.00 to 0.01	0.00	1.00	0.00 to 0.01	0.00	1.00	−0.01 to 0.01	0.00	1.00	0.00 to 0.01
n			10,670			12,040			13,090			4,520
Log likelihood			−5,964.3			−3,559.4			−4,831.3			−2,574.5
BIC			12,202.9			7,398.3			9,932.8			5,374.7

Note: Sample includes the 12,570 sophomores and 10,150 seniors who responded to the 1980 and 1986 High School and Beyond surveys. Note that sample sizes are rounded to the nearest 10 in accordance with National Center for Education Statistics data disclosure policies. All models include the full set of demographic, social background, and childhood health measures described in Table 1. Missing values on independent variables have been imputed using chained equations. Analyses are weighted by RAWWT, and standard errors account for school-level clustering. BIC = Bayesian information criterion.

* $p < .05$.

** $p < .01$.